AN INVESTIGATION OF THE IMPACT OF SOCIAL MEDIA PLATFORMS ON SUPPLY CHAIN PERFORMANCE THROUGH COMPETITIVE INTELLIGENCE USING AHP MODEL

A Dissertation
Submitted to the Graduate Faculty
of the
North Dakota State University
of Agriculture and Applied Science

By

Fesseha Gebremikael

In Partial Fulfillment of the Requirements
for the Degree of
DOCTOR OF PHILOSOPHY

Major Program:
Transportation and Logistics

April 2018

Fargo, North Dakota

North Dakota State University

Graduate School

Title

AN INVESTIGATION OF THE IMPACT OF SOCIAL MEDIA PLATFORMS ON SUPPLY CHAIN PERFORMANCE THROUGH COMPETETIVE INTELLIGENCE USING AHP MODEL

By

Fesseha Gebremikael

The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

DOCTOR OF PHILOSOPHY

SUPERVISORY COMMITTEE:

Dr. Joseph Szmerekovsky
Chair

Dr. Chanchai Tangpong

Dr. Kevin Brooks

Dr. Peter Oduor

Approved:

April 13, 2018
Date

Dr. Joseph Szmerekovsky
Department Chair

ABSTRACT

This study investigates the use of social media platforms (SMPs) for acquiring supply chain intelligence (SCI) to improve supply chain performance. Given the growth of social media use, there is an urgency for increased understanding of the effectiveness of emerging SMPs. In today's competitive global environment, supply chain managers need to have a precise understanding about the SMPs that have become one of the premier sources of gaining SCI and in turn foster supply chain performance. Organizations need a methodology for selecting SMPs to remain proactive ahead of their competitors. The evolution of SMPs has caused a paradigm shift in how organizations obtain SCI to increase their revenues, profitability and reputation. The aim of this study is to apply a multi-criteria analysis using the analytic hierarchy process (AHP) to select SMPs. Stage 1 represents the primary goal, the decision maker wishes to gain in executing SMPs; Stage 2 consists of decision criteria; Stage 3 is composed of sub-criteria; and finally Stage 4 represents the SMP alternatives reported in the organizational hierarchy structure. The objective of this model is to rank the SMPs. The model includes key supply chain performance factors in the organization. The hierarchical models are used to breakdown the complex notion of supply chain performance into its constituent parts. The second phase of the hierarchical model consists of the performance indicators of which supply chain performance is composed. Hence, the modeled value is the supply chain performance in the organization. Our results indicate that the top three supply chain performance indicators are quality, assurance of supply and delivery. Meanwhile the top three types of supply chain intelligence are logistics intelligence, product/process intelligence and supply chain visibility intelligence. The top three SMP alternatives are, LinkedIn, Facebook and Twitter.

ACKNOWLEDGEMENTS

First, I thank almighty God for giving me the boldness and persistence to achieve this daunting task. I am indebted to several individuals who deserve special recognition: my mentor and committee chair, Dr. Joseph Szemerekovsky and committee members Dr Tangpong Chanchai, Dr. Kevin Brooks, and Dr. Peter Oduor. Without all of your kind assistance, continuous support and feedback, I would not have accomplished the levels of achievement that are more than I ever thought possible. Thank you to all of you for your contributions and professional support. In particular, thank you to Dr. Szemerekovsky for standing with me throughout my experience at NDSU. Your suggestions and encouragement have been invaluable. Thank you also to Dr. Denver Tolliver, director of the Transportation and Logistics Program and director of the Upper Great Plains Transportation Institute, for providing the resources to enhance my academic endeavors. Without this assistance, my great academic journey would not have been possible. Thank you to Jody Bohn Baldock, department manager and academic coordinator, for your support and help. Thank you to Dr. Jill Hough, director of the Small Urban and Rural Transit Center, for your support during some difficult times at NDSU. I also acknowledge with gratitude, the support from the entire Upper Great Plains Transportation Institute which made my stay in the Ph.D. program such a cordial experience.

A profound thank you to Joshua Boschee, member of the North Dakota House of Representatives, Richard Preston, and attorney William Earnest of Atlanta for your efforts, motivation and sage guidance. No words can adequately express my gratitude.

My sincere thanks also to Curt Doekott and Kristen Tomanek from the statistics consulting/research analysis group at NDSU and Linda Charlton-Gunderson, technology coordinator for the Group Decision Center, for her assistance. Thank you note also goes to Mr.

Daniel Nygard for taking the time assisting in reviewing and formatting my dissertation, as well as Ms. Laura Trude, who assisted me in search various articles and websites to gather vital information while writing my dissertation.

My appreciation of thanks also goes to Drs. Chris Enyinda, Daryush ILA, Iddrissu Awudu, Charles Briggs, Emeka Dunu, Khalid Bakar and Uchenna Elike.

Thanks to my Fargo friends, Maher Tedla, Taddele Gebresadkan, Estfanos, Merih Kidane and his wife Rahel Gebresadkan, for constantly asking about my progress. To Dr. Getachew Gabre, Dr. Helen Gabre, Teshome Gabre, Dr. Gete Bekele, Dr. Joseph Befacadu, Teferi Tesgaye and his wife Mennen Zewde, Mezemir Wagaw, Mekonnen Lema, Tilahun Mitike, his wife, Hanna Mamo, Girma Kebede, his wife Wossen Haile, Ernie Franza, his wife, Belaynesh Shiferaw, Dr. Darlene Williams, thank you for your assistance, advice and support over the years. To Dr. Semere Habtemichael, his wife, Aki, and his parents Kidane Gebreselassie, his wife, Tsehaynesh Unquay, thank you for your constant prayers and interest in my success.

Throughout the writing of this dissertation, I have enjoyed the love and full support of Abey Fesseha and his family. Your compassionate encouragement made this entire effort achievable.

DEDICATION

This dissertation is dedicated to the memory of my beloved parents, Gebremedhin Zellelew, and Wizero Tsehaytu Berhe, who were not able to witness this achievement. You left "fingerprints of grace" on my life and you will not be forgotten. I miss you dearly every day. My mother, Weizero Kiros Zellelew, helped bring me to this moment and who was not able to witness this achievement. Thank you for all you have done to help me achieve this milestone.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1. INTRODUCTION

The purpose of this study is to investigate the impact of SMPs and how organizations use them as a means of acquiring SCI in the context of business strategy. The main objective of this study is to build a framework that will provide a systematic approach for using SMPs as a source of SCI. This study aims to fill the research gap regarding the impact of SMPs on supply chain intelligence used to improve performance from an organizational context. This study identifies relevant gaps where the literature does not adequately address the study questions. Furthermore, this study argues that certain characteristics of performance and strategy enable organizations to increase the likelihood of adapting SMPs to add extra value.

This study addresses the question of how organizations can leverage SMPs to achieve competitive advantage. This study's contribution is significant because of the lack of research on how intelligence gained from SMPs can impact organizational performance. This study aims to link the SCI from SMPs to supply chain performance. Selecting performance measures is a complex procedure due to the variety of frameworks obtainable in previous literature. At the same time, selecting the appropriate performance metrics and measures is crucial to success and competitiveness. Hence, it is necessary to consider the usefulness of SCI from SMPs for a variety of supply chain performance measures. Therefore, we use a multi-attribute decision-making (MADM) technique, referred to as AHP.

SMPs have become a valuable tool for acquiring SCI. According to Lieb (2009) social media is digital, content-based communication based on the interactions enabled by a plethora of web technologies. As Macafee and De Simone (2012) contends that social media can also be used for information-sharing, relationship-building, and improving communication, coordination, and performance, SMPs provide organizations an opportunity to monitor and analyze consumer

conversations and derive insights from that information to improve their performance. From this stand point, SMPs can be useful for supply chain organizations, by serving as an important channel by which past customers can share their experiences with potential customers (Ang, 2011).

According to Dey et al. (2011), competitive intelligence can be defined as summarizing, collecting, and examining intelligence about products, shoppers, competitors and any features of the environment necessary to assist senior management officials in making prudent decisions for firms. SMPs permit for a wide variety of pursuits including worldwide information access, discussion, groups and file transfer facilities, all of which impact business strategies (Kietzmann et al., 2011; Fill, 2009; Chaffrey et al., 2009; DiStaso et al., 2012; Vuori et al., 2011). The popularity of SMPs such as Twitter, Facebook, LinkedIn, Instagram and others is growing rapidly and cannot be ignored as a means of fostering and preserving connections. A small number of organizations are already leveraging the above mentioned sites to improve SCI endeavors.

Decision makers have to earnestly alter their strategic moves and counter moves to address this emergence of a social media landscape. Doing so will facilitate gathering large volumes of information in order to be well informed of global competitive events. Though acquiring intelligence is not easy, there are organizations using SMPs to gather intelligence so as to be proactive in advancing their business goals. These types of intelligence from SMPs have allowed organizations to assess the competitive environment by tracking its advancement. Even though there are an increasing number of organizations developing an SMP presence, only a small number of academic studies have focused on SMPs as a marketing intelligence tool. Therefore, this study aims to analyze SMPs in a business context, illustrating how SMPs can assist firms to understand the global evolution of market trends, as well as to monitor competitors' strategies in order to

provide a theoretical framework for SMPs in the context of SCI and to discuss their benefits and limitations.

As mentioned previously, it is necessary to consider the usefulness of SCI from SMPs for a variety of supply chain performance measures. Therefore, we use AHP as it is a MADM technique. AHP was developed by Saaty (1980) for decision-making when the desired goal has multiple and conflicting criteria. AHP provides a decision framework for pairwise comparison which will allow identification of the importance of different performance measures, the importance of different types of SCIs to those performance measures, and the importance of different SMPs to the different types of SCIs. In the next section, we review relevant literature on competitive intelligence (CI), SCI, and SMPs. In Section 3, we present the study methodology and data analysis. In Section 4, we provide the results. Finally, Section 5 provides the conclusions and future research.

Problem Statement

SMPs have been the speediest, fastest growing, and most constantly changing aspect of media. SMPs are becoming indispensable for doing business in the current age. Despite the challenges associated with adopting new ways of doing business, organizations without a systematic approach to using SMPs are at a significant disadvantage to competitors that leverage the technology. For, as indicated by Mangold and Faulds (2009), consumers are increasingly turning to social media when making buying decisions and communicating their purchase experiences. Despite all this, many organizations continue to ignore the opportunities and threats SMPs represent. One potential cause of this is a lack of understanding regarding what SMPs are and the forms they can take (Kaplan and Haenlein, 2010). Another possible explanation is the general trend among executives and managers to disregard the opportunities and threats presented

by creative consumers, even while recognizing their importance (Berthon, Pitt, McCarthy & Kates, 2007). This current state of the use of SMPs has resulted in a study gap in terms of a lack of an understanding of how organizations can utilize SMP to advance organizational performance, and, in particular, Supply chain performance. In particular, research has shown that using the same SMPs does not necessarily provide the same outcome for competitors. Rather, organizations with clear strategic planning and effective execution have a competitive advantage (Cogburn and Espinoza- Vasquez, 2011; Kreiss, 2012a). Hence, it is crucial for organizations to devise a plan for incorporating SMPs into daily operations (Chikandiwa, Contogiannis & Jembere, 2013).

Purpose

The purpose of the study is to understand the value of SMPs in obtaining SCI to improve Supply chain performance. The study analyzes the perceptions of supply chain professionals in regard to how SMPs can be used to impact Supply chain performance through SCI.

Research Objective

The primary objective of this study is to use AHP to investigate the extent to which SMPs are utilized to obtain SCI. The study centers on key questions facing organizations with regard to using SMPs to improve Supply chain performance.

This study was guided by the following set of questions that have been formulated from the primary objective:

1. How are SMPs important to SCI?
2. How is SCI important to Supply chain performance?

Based on the basis of the study questions, the following analysis will be done**:**

1. For what types of SCI do supply chain professionals use SMPs?
2. For what aspects of Supply chain performance do supply chain professionals rely on

SCI?

3. Which aspects of Supply chain performance are most important?

Summary

The study investigates key questions confronting organizations regarding the use of SMPs to gather SCI to improve Supply chain performance. This study provides a brief background of SMPs, looking at the trend toward increased utilization of SMPs, evaluating how supply chain performance has evolved by leveraging these emerging technologies, to promote organizational performance objectives. The study presented explores how SMPs can be used for Supply chain performance; and analyzes the effect of their use on SCI.

CHAPTER 2. LITERATURE REVIEW

Our research is related to research on competitive intelligence and, more specifically, its use for SCI and dependence on SMPs. Some studies describe SCI as being focused on a technical analysis of internal data, e. g. the combination of data from warehousing systems (Stefanovic and Stefanovic, 2009). This gathering and combining of data across internal systems for analysis can lead to improved business decisions. However, information available internally to an organization is not the only source of SCI. Other studies emphasize utilizing CI as a source of SCI to improve the operations of a global supply chain since competition today is among supply chains (Gunasekaran et al., 2004; Cox, 1999). This perspective on SCI focuses on improving efficiency and agility to improve competitiveness in the marketplace. Wilkins (2007) describes SCI as the art of acquiring, presenting, analyzing, and refining knowledge about the competition's supply chains and then reaching actionable conclusions about potential improvements in the organization. As we seek to relate SMPs to SCI and SCI to performance, this more holistic view of SCI is more appropriate for our study. Therefore, we use the following definition of SCI from Jaharuddin et al. (2014) which incorporates various notions of CI (Calof and Skinner, 1999; Wright and Calof, 2006; Tej Adidam et al., 2012) and SCM (Chopra and Meindl, 2001): "a set of systematic intelligence processes concerning opportunities or developments that have the potential to affect individual firms and their supply chain networks as a whole towards improving long-term performance" (Jaharuddin et al., 2014, P. 180).

Based on this notion of SCI, SMPs should have a critical role in developing SCI. Similar to Kaplan and Haenlein (2010), our research defines social media as a group of internet-based applications that create the possibility for user-generated content to be published and shared. SMPs allow organizations to access market information which they use to improve customer satisfaction

and market performance. Therefore, SMPs constitute a vital tool for organizations to gather information on consumers as well as their rivals' products (Rappaport, 2011). Furthermore, Kietzmann, et al. (2011) indicate that social media has revolutionized interactions and communications among individuals, communities and companies. Similarly, Vuori and Väisänen (2009) indicate that SMPs can also promote human interaction, publishing, and generally facilitate the sharing of information through easily accessible web-linked platforms. Finally, acknowledging the importance of social media, Gundecha and Liu (2012) state "Mining social media has its potential to extract actionable patterns that can be beneficial for business, users, and consumers".

For several years now, SMPs have become an increasingly important means by which consumers exchange points of view, affection, and thoughts**.** For a company, the use of social media can be either exploitative in the sense of making incremental improvements in existing processes by drawing on existing knowledge, or explorative, in the sense of creating new business models and drawing on new sources of knowledge (Subramani, 2004; Gupta et al., 2007). Haji et al. (2015) contend that in online communities, consumers exchange information that constitutes an indispensable information source for organizations. In other words, organizations can hear consumers' views and opinions as they unfold. According to He et al. (2013); and Moe and Schweidel (2014), social media intelligence has evolved in the last several years with the goal of attaining actionable information from SMPs, generating viable solutions for advanced applications (Zeng et al., 2010). In particular, social media intelligence connects social media data to strategic management decisions and business performance. Based on a statement made by Levy et al. (2013), social media data can reflect direct and immediate market reactions and, since social media data are mostly generated by individuals rather than marketers or companies, consumers often consider social media content to be inherently trustworthy.

Culnan et al. (2010) points out that organizational performance or productivity is not derived from an SMP itself, but from how it is used. Similarly, Bughin and Chui (2010) raise the issue of identifying the potential leverage points of competitive advantage related to using SMPs in various functions /or parts of the organizations. The goal of our study is to enhance understanding of the uses of SMPs within the supply chain. Social media has seen much use in supply chains. For example, Singh et al. (2017) show how Twitter data can be used to identify supply chain management issues in food industries. The method is based on text analysis using a support vector machine and hierarchical clustering with multiscale bootstrap resampling. Ultimately, a cluster of words is identified that can be used by decision makers to identify quality issues in the supply chain. Also in the food industry, Meixner et al. (2013) study the use of social media for customer relationship in the Austrian food and beverage supply chain. They conclude that social media has potential for customer relationship management, but that more knowledge on how to use it is needed. Another example is Choi (2016) who shows the importance of good social media comments to the value of a quick response program in the fashion industry. Lin et al. (2017) also study how to incorporate social media data into supply chain management by considering its use in green supplier selection. They do this by extending the concept of a fuzzy weighted average to include social media data and demonstrate its effectiveness for green supplier selection in the light-emitting diode industry. Social media has also been suggested for recruitment of global supply chain managers. Fisher et al. (2014) investigate how social media is being used to recruit global supply chain managers. They find that the supply chain industry is currently lagging other industries in the adoption of social media techniques for recruitment. Finally O'Leary (2011) provides a survey on the use of social media in the supply chain. Though much work has been done on social media and supply chains, none has explored the choice of SMP for

gaining SCI to improve supply chain intelligence. Therefore, we are the first to study the linkages between SMPs, SCI, and supply chain performance.

To that end we make use of a MADM technique, specifically AHP. AHP was developed by Saaty (1980) for decision-making when the desired goal has multiple and conflicting criteria. AHP provides a decision framework for pairwise comparison which will allow identification of the importance of different performance measures, the importance of different types of SCIs to those performance measures, and the importance of different SMPs to the different types of SCIs. Gavade (2014) provides a review of various multi-criteria decision-making problems and methods, including AHP. Strengths and weaknesses of AHP are identified by Gavade (2014). The strengths are its ability to support group decision-making, intuitiveness in ranking alternatives, flexibility in capturing multiple criteria, and the ability to check inconsistencies in responses. The weaknesses are the large number of comparisons that each participant must make and the artificial precision of its nine-point scale. Assumptions of AHP are identified by Bentes et al. (2012). Specifically, Bentes et al. (2012) indicate that AHP assumes a formative perspective of measurement and that a decision-maker's preferred alternative is more easily revealed by comparing one pair of alternatives at a time.

There is significant precedent for using AHP for supply chain research. For example, focusing on identifying supply chain risk elements, Gaudenzi and Borghesi (2006) developed an AHP model to assess supply chain risks. They assessed risk factors with a view to enhance customer value through a two phase method of prioritizing supply chain objectives and selecting risk indicators. Their findings state that, appreciation of the most critical supply chain risks comes from meticulous assessment of the impacts and a deliberation of the cause-effect connections. They found in their case study the two most divergent evaluations were from the logistics manager

and the sales manager. Wu et al. (2006) used a hierarchical risk factor classification with AHP to rank inbound supply risk factors. They developed a prototype information system and validated its usefulness through a case study. Thomas J. Kull and Srinivas (2008), combined AHP and goal programming to select suppliers while accounting for supply risk and product life-cycle issues. Their method was tested with a case study for which the AHP and goal programming components both provided results consistent with managers' knowledge. In particular, the AHP process was helpful in identifying priorities and revealing previously unknown issues. Wang et al. (2012) formulated a two-stage Fuzzy AHP model to evaluate the risk of implementing green initiatives in the fashion supply chain. The purpose of the model was to analyze the associated risk of different alternatives, subject to both deterministic and non-deterministic factors. They tested their model with three green initiatives (i.e. implementing new green materials, reducing greenhouse gas emissions in distribution, and reducing packaging) for three different types of fashion retailers (i.e. high street fashion targeting young consumers, supermarket chain, and luxury fashion). Their analysis demonstrated that their model can prioritize the risk across the different retailer scenarios.

For example, reducing the packaging carried a high risk for the luxury fashion retailer which used packaging to help with salability and marketability but was a low risk for the supermarket chain. Dong and Cooper (2016), developed an orders-of-magnitude AHP based ex-ante supply chain risk evaluation model, to allow comparison of both tangible and intangible factors that impact supply chain risks. Their effectiveness of the model was tested on a telecommunications equipment and services company in China. The results of the analysis showed that the model was able to effectively partition risks into critical, high, intermediate, and low categories. Luthra, et al. (2016) developed AHP with the aim of identifying and assessing barriers related to the adoption of sustainable consumption and production initiatives in the supply chain.

The identified barriers were evaluated to determine their relative importance using AHP. The usefulness of the proposed method is shown by evaluating the case of a plastic manufacturer in India. Their findings indicates that barriers associated with government help and policies were the most important in effecting adoption of sustainable consumption and production initiatives in the supply chain. We contribute to the stream of research which leverages AHP's ability to deal with multi-attribute decision problems in supply chain management by being the first to use AHP to prioritize the role of various SMPs in building various forms of SI to improve supply chain performance.

Summary

This chapter deliberates pertinent literature on the SMP episode as a basis for analysis of the study data; the ongoing paradigm shift, where SMPs have significantly altered the global competitive landscape. This chapter also covers how SMP technology is being leveraged to facilitate the advancement of organizational performance and the advantages and disadvantages of this trend. Finally, this chapter discusses the techniques adopted for the study and the limitations identified in completing the study.

CHAPTER 3. AHP METHODOLOGY

The analytic hierarchy process is used as the method for this study. AHP is a superior methodology for decomposing, grouping and examining complicated issues as it is widely applied and easy to use (Luthra et al., 2016)). Therefore, we implement AHP to assess criteria related to the supply chain performance strategies in supply chains. The framework of this study is illustrated in Figure 1. The key decision criteria and sub-criteria for how SCI impacts supply chain performance are given in Tables 1 and 2.

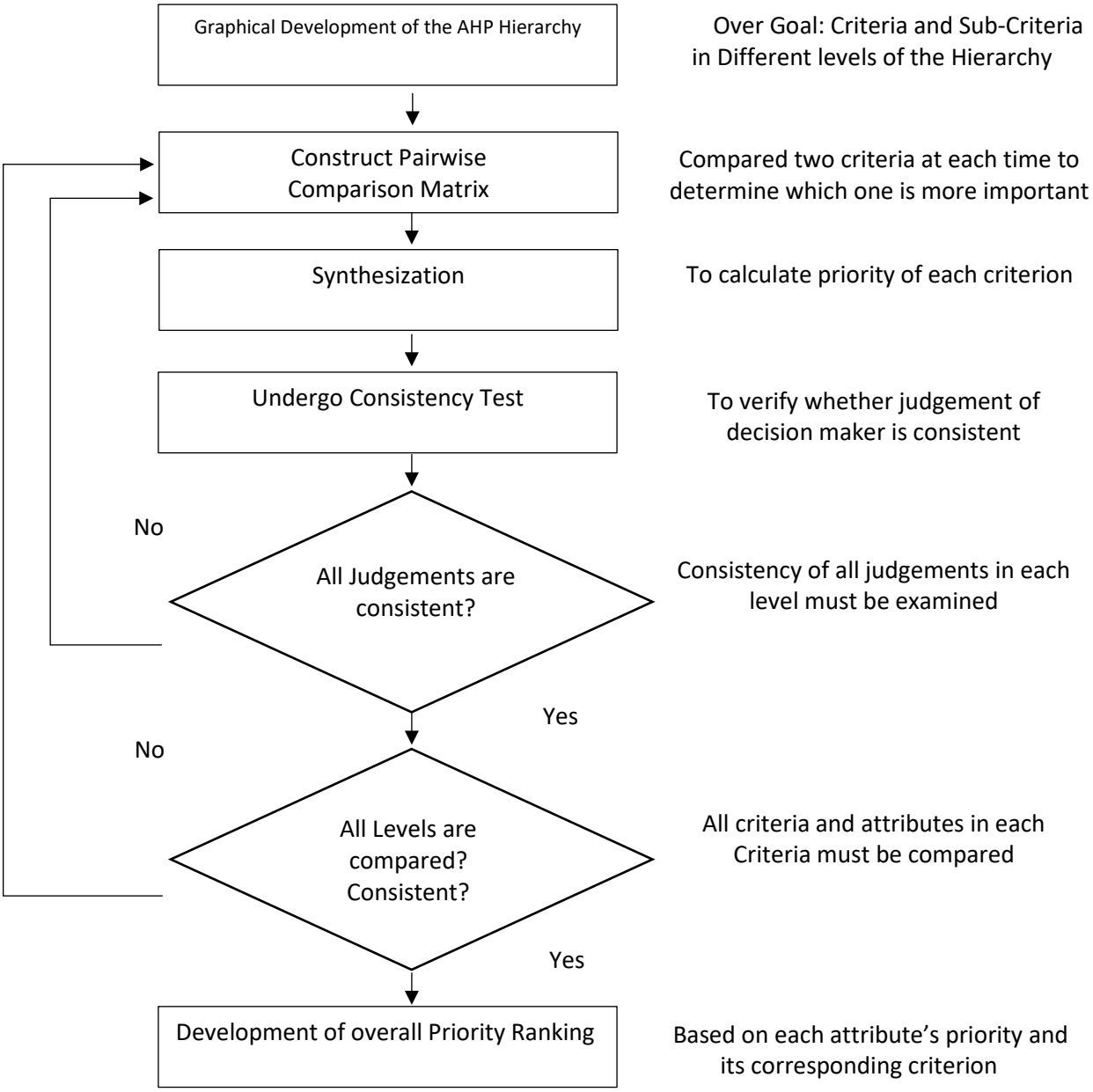

Figure 1. Framework of the study

Table 1. Decision criteria for supply chain performance

Key Decision Criteria Terms	Explanation
Delivery	The correct product, to the correct place, and to the correct customer and manufacturer at the correct time, in perfect condition and packaging, in the correct quantity with the correct documentation.
Quality	Quality is customer satisfaction or fitness for use.
Assurance of supply	Intelligence on the competition between downstream firms that are competing for inputs in limited supply.
Flexibility	Flexibility is the organizational ability to meet an increasing variety of customer expectations without excessive cost, time, disruption or loss.
Cost	The cost associated with operating the supply chain.

Source: (Sarode et al., 2008).

Table 2. Sub-criteria for supply chain performance

Sub-criteria Terms	Explanation
Demand Intelligence	Intelligence about activities that the end customer values and is willing to pay for.
Product/Process Intelligence	Intelligence that addresses manufacturing.
Supplier Intelligence	Intelligence that seeks to understand the relationships between the firm and its major suppliers.
Logistics Intelligence	Intelligence that takes the changing "landscape" in demand intelligence and determines the optimal response, maximizing customer value and how it affects manufacturing production capacity and schedules, the logistics network, and inventory policy.
Political/Economic Intelligence	Intelligence that relates to political, technological, and economic changes on a global scale, disrupting markets which used to be considered stable.
Supply Chain Visibility Intelligence	Intelligence that provides access to high quality information that describes various factors of demand and supply.

Source: (Haydock, 2003) and (Williams et al. 2013) and (Klaus, 2011)

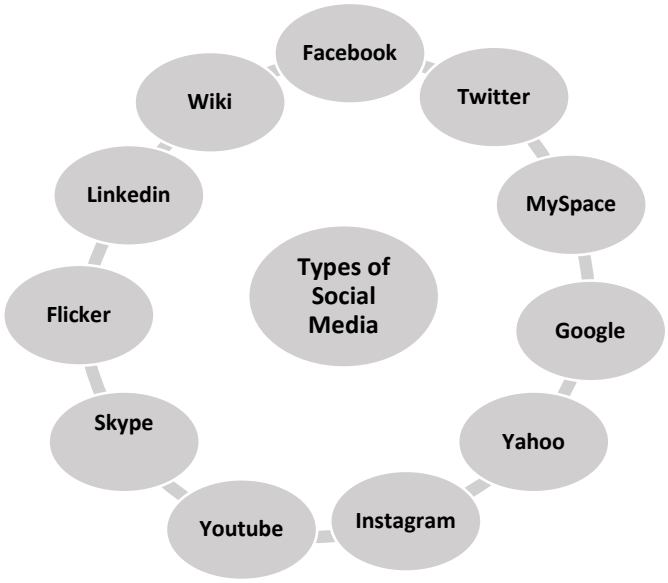

Figure 2. Social Media Platforms
Source from Kaplan and Haenlein (2010)

Table 3. Popular Social Media Platforms

Type	Platform Types	Definition
Social Networking	Facebook, LinkedIn	Content sharing, mainly personal and business information.
Microblogging	Twitter	Blogging (online diaries), mainly text based that uses hashtags (less than 140 characters).
Media	YouTube/ Instagram	Content sharing, mainly videos and photographs.

Source: Adopted from (Kaplan & Haenlein, 2010)

Social Media Platforms

Figure 1 depicts a variety of SMPs, the most popular of which are: Facebook, Twitter, LinkedIn, Instagram, and YouTube. Our study will focus on these five most popular SMPs as they have outpaced the use of other SMPs. For example, Griffiths and Wall (2011) explain how despite being one of the earliest SMPs Myspace, and similar sites such as Classmates and Six Degrees, have been outpaced at a rapid speed by Facebook. Table 3 provides a classification of the five SMPs into three types: social networking, microblogging, and media. We next provide a brief description of each SMP.

A Brief Description of Popular Social Media Platforms

1. **Facebook**: A web site for social networking that allows users to make a personalized webpage. Typically the page contains information on political party affiliation, sport teams, employment, and/or religious beliefs important to the user (Webb et al., 2012).
2. **Twitter**. A microblogging SMP used to communicate information or brief messages in a societal news stream through tweets that are up to 140 characters.
3. **LinkedIn**. A website that allows professionals to provide a personal profile. Users can share messages related to professional goals and needs These messages can be targeted to specific audiences. In addition, news articles and discussions on LinkedIn may be

"featured?" (Makrez, 2011). In addition to serving as a professional hub for delivering messages, LinkedIn has seen use by educational organizations as a means to contact graduates and keep them in touch with the educational organization (Makrez, 2011).

4. **YouTube**. A website centered around online video that allows users to upload and share video clips with few impediments. As has been elaborated by both Dixon (2012) and Wheeler (2013), YouTube is the world's "most popular video-sharing site" and "the second most utilized search engine on the planet".
5. **Instagram**. Allows individuals to readily share images directly from their mobile phones with an online community.

We next detail the basic steps of AHP analysis.

AHP Steps

1. Formulation of the aim of the study. In our case the aim of the study is to identify which SMPs impact supply chain performance through SCI.
2. Develop the pairwise comparisons. As a MADM, AHP includes comparing the importance of the various attributes for decision making. In our study the pairwise comparisons are conducted by means of data collection from supply chain professionals based on expert judgment. The pairwise comparisons among the factors are rated through a nine-point scale as shown in Table 4.
3. Computation of the Eigenvalues and Eigenvectors (referred to by Saaty (1980) as geometric means and relative importance weights. The pairwise comparisons from Step 2 are represented as matrices which are used to calculate the Eigenvalues and Eigenvectors that are further analyzed to compute the relative importance weights of the key decision factors.

4. Evaluation of the consistency ratio: The consistency ratio (CR) is computed to assure the consistency of pairwise comparisons. The mathematical expression used for finding the CR is provided as CR = CI/RI. Here CI is the consistency index (λ_{max} - n)/ (n - 1) (λ_{max} is the maximum average value) and RI is the random consistency index (RI) which is determined by the value of n. According to Luthra et al., (2016), a CR ≤ 0.10 indicates acceptable consistency.

Table 4. Scale in pairwise comparison

Importance Intensity	Preference Judgement
1	Equally Important
3	Moderately Important
5	Strongly Important
7	Extremely Important
9	Extremely more Important
2, 4, 6, 8	Intermediate values between adjacent values

Source: Saaty (1980)

AHP Application

The aim of this stage is to identify the linkages between supply chain performance, SCI, and SMPs. Figure 3 provides a graphical representation of these linkages with the primary goal (Level i), key decision criteria (supply chain performance measures, Level ii), sub-criteria (types of SCI, Level iii) and alternatives (SMPs, Level iv).

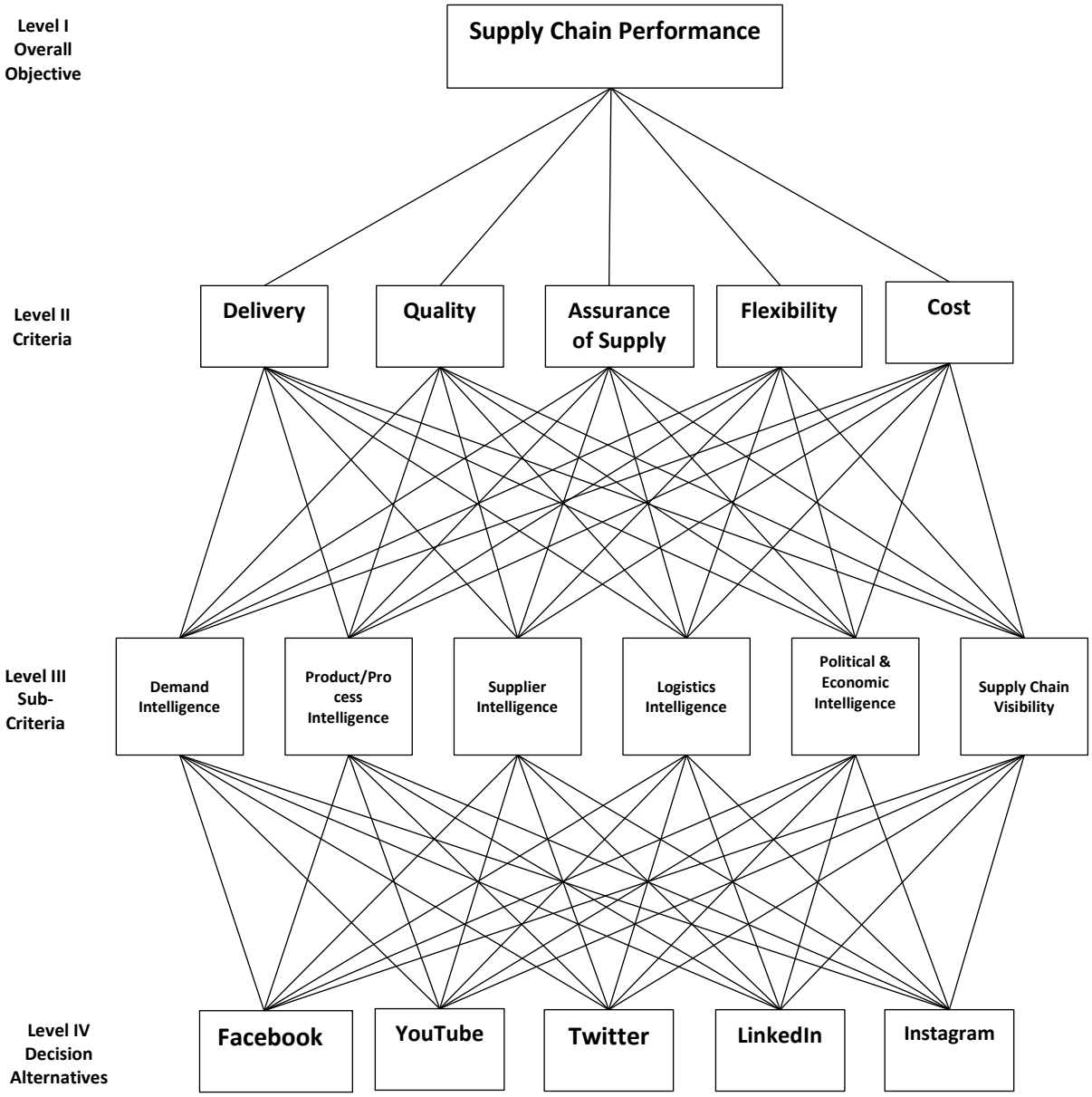

Figure 3. AHP Based hierarchical model to evaluate supply chain performance strategic factors criteria

Summary

This chapter discussed the AHP methodology and its application to our study.

CHAPTER 4. DATA ANALYSIS AND RESULTS

The survey used for our study can be found in Appendix A and the corresponding cover letter can be found in Appendix B. Sample calculations can be found in Appendix C and the SAS code used for the study can be found in Appendix D. The survey was conducted through Qualtrics and was originally sent out to 51 supply chain professionals with the majority of their contact information being obtained through the online database Data.com Connect. Of the 51 supply chain professionals contacted, six responded to the survey. The ratings obtained from supply chain professionals input were input into Excel and then read into SAS where calculations for obtaining priorities were performed using the AHP methodology.

The letter to participants (Appendix A) confirms that personal information such as names and employers will not be disclosed. This study was designed under provisions mandated by North Dakota State University's (NDSU) Institutional Review Board Manual. An application was submitted to NDSU's Institutional Review Board requesting (a) that this study be classified as exempt research, and (b) a waiver of the informed consent process be given. Federal regulations allow for waiver of consent requirements if the research involves no more than minimal risk and the waiver will not adversely impact the rights and welfare of the subjects. The application for exempt research was made based on the study not presenting more than a minimal risk to its subjects. Prior to the study start, the study design was approved by NDSU's Institutional Review Board.

Demographic Summary

Initially six supply chain professionals participated in this study, however, after calculating the CR values, one was found to have a CR of $0.40 > 0.10$. As discussed in Chapter 3, such a large CR indicates inconsistent responses and the participant was omitted from further analysis. The

demographic information on familiarity with the concepts used in the study (Questions 13-15) for the five remaining participants is detailed in Tables 5-7. From the tables it can be seen that with the exception of assurance of supply the majority of respondents are very familiar with the supply chain performance measures. Also, all respondents are at least somewhat familiar with all supply chain performance measures. Similarly, it can be seen that most respondents are at least somewhat familiar with the types of SCI, with the exception being one who is only slightly familiar with product/process intelligence and one who is only slightly familiar with political/economic intelligence. Finally, most are familiar with the SMPs with one being only slightly familiar with Twitter and two being only slightly familiar with Instagram.

The remaining demographic details of the respondents were collected in Questions 16-19. From the overall responses, the five supply chain professionals that responded to the survey listed their industries as “Service”, “Higher Education/Maritime Industry”, “Logistics/Transportation”, “Supply Chain and Transportation”, and “Logistics”. As far as supply chain professionals’ current position titles are concerned, one indicated “CEO”, one indicated “Professor”, one indicated “General Manager”, and two indicated “Sales Executive”. Years of managerial work experience ranged from five to thirty. Four of the participants indicated “Caucasian” for ethnicity and one indicated “non-Caucasian” for ethnicity. Four indicated “male” for sex and one indicated “female” for sex.

Table 5. Participant's familiarity with supply chain performances

Number of Participants	Familiarity				
Delivery	**1**	**2**	**3**	**4**	**5**
1			**x**		
1				**x**	
3					**x**
Quality	**1**	**2**	**3**	**4**	**5**
2			**x**		
3					**x**
Assurance of supply	**1**	**2**	**3**	**4**	**5**
4			**x**		
1					**x**
Flexibility	**1**	**2**	**3**	**4**	**5**
1			**x**		
3				**x**	**x**
1					**x**
Cost	**1**	**2**	**3**	**4**	**5**
2			**x**		
3					**x**

Table 6. Participant's familiarity with SCI performance measures

Number of Participants	Familiarity				
Demand	**1**	**2**	**3**	**4**	**5**
2			**x**		
3					**x**
Product/Process	**1**	**2**	**3**	**4**	**5**
1		**x**			
2			**x**		
2					**x**
Supplier	**1**	**2**	**3**	**4**	**5**
2			**x**		
1				**x**	
2					**x**
Logistics	**1**	**2**	**3**	**4**	**5**
2			**x**		
1				**x**	
2					**x**
Political/Economic	**1**	**2**	**3**	**4**	**5**
1		**x**			
2			**x**		
1				**x**	
1					**x**
Supply Chain Visibility	**1**	**2**	**3**	**4**	**5**
1			**x**		
3				**x**	
1					**x**

Table 7. Participant's familiarity with each of the SMPs

Number of Participants	Familiarity				
Facebook	**1**	**2**	**3**	**4**	**5**
1			**x**		
1				**x**	
3					**x**
YouTube	**1**	**2**	**3**	**4**	**5**
1				**x**	
4					**x**
Twitter	**1**	**2**	**3**	**4**	**5**
1		**x**			
1			**x**		
2				**x**	
1					**x**
LinkedIn	**1**	**2**	**3**	**4**	**5**
2				**x**	
3					**x**
Instagram	**1**	**2**	**3**	**4**	**5**
2		**x**			
3			**x**		

Data Analysis

Using Saaty's 9-point scale, the participants provided relative rates for all pairwise comparisons shown in Appendix A. The normalized pairwise comparison matrix for the measures of supply chain performance appears in Table 8. The pairwise comparisons for types of SCI for each measure of supply chain performance are shown in Tables 9 -13. Note that the CR values provided in Tables 8-13 indicate that all results are acceptable (i.e. the CR<0.10). The pairwise comparisons for types of SCI with SMPs for each measure of supply chain performance are shown in Tables 14-18. The overall priorities for supply chain performance measures, types of SCI, and SMPs are given in Tables 19-21.

Table 8. Normalized Pairwise Comparison Matrix of the main criteria with respect to the Goal

Criteria→↓	Delivery	Quality	Assurance of supply	Flexibility	Cost	Weight	Rank
Delivery	1	5/8	5/6	1	8/5	0.190	3
Quality	8/5	1	7/5	7/5	7/5	0.256	1
Assurance of supply	6/5	5/6	1	7/5	6/5	0.230	2
Flexibility	1	5/7	5/7	1	1	0.171	4
Cost	5/8	5/7	5/8	1	1	0.125	5

Maximum Eigenvalue = 5.033 CI= 0.007

Table 8 provides the relative importance of the supply chain performance measures. Larger values indicate greater importance of the supply chain performance measure on the vertical axis relative to the supply chain performance measure on the horizontal axis. Thus, Table 8 indicates that quality is the most important measure of supply chain performance followed by assurance of supply, delivery, flexibility and cost, in that order.

Table 9. Pairwise comparison matrix for the sub-criteria with respect to Delivery

	DI	PPI	SI	LI	PEI	SCVI	Priority	Rank
DI	1.000	1.000	1.200	0.714	1.000	0.625	0.147	4
PPI	1.000	1.000	1.400	0.714	1.400	1.000	0.172	3
SI	0.833	0.714	1.000	0.556	1.600	1.000	0.149	5
LI	1.400	1.400	1.800	1.000	1.400	1.000	0.213	1
PEI	1.000	0.714	0.625	0.714	1.000	0.556	0.123	6
SCVI	1.600	1.000	1.000	1.000	1.800	1.000	0.196	2

Maximum Eigenvalue =6.079 CI= 0.013

Table 10. Pairwise comparison matrix for the sub-criteria with respect to Quality

	DI	PPI	SI	LI	PEI	SCVI	Priority	Rank
DI	1.000	1.200	0.833	1.200	1.800	1.400	0.196	1
PPI	0.833	1.000	1.200	1.200	1.400	1.400	0.189	2
SI	1.200	0.833	1.000	1.200	1.800	1.400	0.196	1
LI	0.833	0.833	0.833	1.000	1.600	1.200	0.165	3
PEI	0.556	0.714	0.556	0.625	1.000	0.625	0.109	6
SCVI	0.714	0.714	0.714	0.833	1.600	1.000	0.144	5

Maximum Eigenvalue =6.033 CI= 0.005

The three more important forms of SCI for quality were found to be demand intelligence and supplier intelligence both are tied, product produce intelligence and logistics intelligence.

Table 11. Pairwise comparison matrix for the sub-criteria with respect to Assurance of Supply

	DI	PPI	SI	LI	PEI	SCVI	Priority	Rank
DI	1.000	2.000	0.833	0.714	1.400	0.714	0.172	3
PPI	0.500	1.000	0.625	1.200	1.600	1.400	0.163	5
SI	1.200	1.600	1.000	1.200	1.400	1.400	0.206	1
LI	1.400	0.833	0.833	1.000	1.800	0.625	0.167	4
PEI	0.714	0.625	0.714	0.556	1.000	0.714	0.114	6
SCVI	1.400	0.714	0.714	1.600	1.400	1.000	0.178	2

Maximum Eigenvalue =6.212 CI= 0.034

The three more important forms of SCI for assurance of supply were found to be supplier intelligence, supply chain visibility intelligence and demand intelligence.

Table 12. Pairwise comparison matrix for the sub-criteria with respect to Flexibility

	DI	PPI	SI	LI	PEI	SCVI	Priority	Rank
DI	1.000	1.000	1.600	0.625	1.000	1.200	0.170	4
PPI	1.000	1.000	1.800	0.833	1.600	0.833	0.182	3
SI	0.625	0.556	1.000	0.625	1.400	0.625	0.125	6
LI	1.600	1.200	1.600	1.000	1.400	0.833	0.202	1
PEI	1.000	0.625	0.714	0.714	1.000	0.714	0.129	5
SCVI	0.833	1.200	1.600	1.200	1.400	1.000	0.193	2

Maximum Eigenvalue =6.097 CI= 0.016

The three more important forms of SCI for flexibility were found to be logistics intelligence, supply chain visibility intelligence and product produce intelligence.

Table 13. Pairwise comparison matrix for the sub-criteria with respect to Cost

	DI	PPI	SI	LI	PEI	SCVI	Priority	Rank
DI	1.000	0.714	1.200	0.833	1.200	1.000	0.160	4
PPI	1.400	1.000	0.833	1.000	1.400	1.400	0.190	2
SI	0.833	1.200	1.000	0.714	1.400	0.833	0.162	3
LI	1.200	1.000	1.400	1.000	1.600	1.400	0.204	1
PEI	0.833	0.714	0.714	0.625	1.000	0.833	0.127	6
SCVI	1.000	0.714	1.200	0.714	1.200	1.000	0.156	5

Maximum Eigenvalue =6.049 CI= 0.008

Table 9 evaluates the types of SCI relative to the importance for the delivery measure of supply chain performance. Similarly Tables 10-13 provide the comparisons for quality, assurance of supply, flexibility, and cost. The three most important forms of SCI for delivery were found to be logistics intelligence, supply chain visibility intelligence and product/process intelligence. The three most important forms of SCI for quality were found to be demand intelligence, supply intelligence and product/process intelligence. The three most important forms of SCI for assurance of supply were found to be supply intelligence, supply chain visibility intelligence and demand intelligence. The three most important forms of SCI for flexibility were found to be logistics intelligence, supply chain visibility intelligence and product/process intelligence. The three most important forms of SCI for cost were found to be logistics intelligence, product/process intelligence and supply intelligence.

Table 14. Global priorities of alternatives with respect to sub-criteria (under each criterion) for SMPs

Criteria: Delivery	**Priorities**				
Sub-criteria	**FB**	**IG**	**LI**	**TW**	**YT**
DI	0.006	0.004	0.008	0.005	0.004
PPI	0.005	0.004	0.011	0.005	0.007
SI	0.006	0.003	0.011	0.004	0.005
LI	0.009	0.004	0.012	0.007	0.008
PEI	0.006	0.003	0.005	0.007	0.003
SCVI	0.007	0.006	0.013	0.006	0.005

The pairwise comparisons for types of SCI with SMPs for the delivery measure of supply chain performance are shown in Table 14. From the table it is clear to see that LinkedIn is the most important SMP for most types of SCI relevant to delivery performance, the exception being political/economic performance for which Twitter was most important. It can also be seen that Face Book is second in importance with the exception of product/process intelligence, for which YouTube was second in importance. All SMPs were of third importance (or tied for third importance) at least once for delivery performance.

Table 15. Global priorities of alternatives with respect to sub-criteria (under each criterion) for SMPs

Criteria: Quality	**Priorities**				
Sub-criteria	**FB**	**IG**	**LI**	**TW**	**YT**
DI	0.011	0.007	0.015	0.009	0.008
PPI	0.008	0.006	0.017	0.007	0.010
SI	0.010	0.005	0.019	0.008	0.008
LI	0.010	0.005	0.013	0.007	0.008
PEI	0.007	0.003	0.006	0.008	0.004
SCVI	0.007	0.006	0.013	0.006	0.005

The pairwise comparisons for types of SCI with SMPs for the quality measure of supply chain performance are shown in Table 15. From the table it is clear to see that LinkedIn is again

the most important SMP for most types of SCI relevant to quality performance, the exception being political/economic performance for which Twitter was most important. It can also be seen that Face Book is again second in importance with the exception of product/process intelligence, for which YouTube was second in importance. All SMPs were of third importance (or tied for third importance) at least once for quality performance.

Table 16. Global priorities of alternatives with respect to sub-criteria (under each criterion) for LinkedIn, Facebook, Twitter, YouTube and Instagram

Criteria: Assurance	**Priorities**				
Sub-criteria	**FB**	**IG**	**LI**	**TW**	**YT**
DI	0.008	0.006	0.012	0.007	0.006
PPI	0.006	0.005	0.013	0.006	0.008
SI	0.010	0.005	0.018	0.007	0.008
LI	0.009	0.004	0.012	0.006	0.007
PEI	0.006	0.003	0.006	0.007	0.004
SCVI	0.008	0.007	0.014	0.006	0.006

The pairwise comparisons for types of SCI with SMPs for the assurance of supply measure of supply chain performance are shown in Table 16. From the table it is clear to see that LinkedIn is again the most important SMP for most types of SCI relevant to assurance of supply performance, the exception being political/economic performance for which Twitter was most important. It can also be seen that Face Book is again second in importance with the exception of product/process intelligence, for which YouTube was second in importance. All SMPs were of third importance (or tied for third importance) at least once for assurance of supply performance.

Table 17. Global priorities of alternatives with respect to sub-criteria (under each criterion) for Facebook, Instagram, LinkedIn, Twitter and YouTube

Criteria: Flexibility	**Priorities**				
Sub-criteria	**FB**	**IG**	**LI**	**TW**	**YT**
DI	0.006	0.004	0.009	0.005	0.005
PPI	0.005	0.004	0.011	0.005	0.007
SI	0.004	0.002	0.008	0.003	0.004
LI	0.008	0.004	0.010	0.006	0.007
PEI	0.005	0.002	0.005	0.006	0.003
SCVI	0.006	0.005	0.011	0.005	0.005

The pairwise comparisons for types of SCI with SMPs for the flexibility measure of supply chain performance are shown in Table 17. From the table it is clear to see that LinkedIn is again the most important SMP for most types of SCI relevant to flexibility performance, the exception being political/economic performance for which Twitter was most important. It can also be seen that Face Book is again second (or tied for second) in importance with the exception of product/process intelligence, for which YouTube was second in importance. All SMPs were of third importance (or tied for third importance) at least once for flexibility performance.

Table 18. Global priorities of alternatives with respect to sub-criteria (under each criterion) for SMPs

Criteria: Cost	**Priorities**				
Sub-criteria	**FB**	**IG**	**LI**	**TW**	**YT**
DI	0.005	0.004	0.007	0.005	0.004
PPI	0.005	0.004	0.010	0.004	0.006
SI	0.005	0.002	0.009	0.004	0.004
LI	0.007	0.003	0.009	0.005	0.006
PEI	0.005	0.002	0.005	0.006	0.003
SCVI	0.005	0.004	0.008	0.004	0.004

The pairwise comparisons for types of SCI with SMPs for the cost measure of supply chain performance are shown in Table 18. From the table it is clear to see that LinkedIn is again the most important SMP for most types of SCI relevant to cost performance, the exception being political/economic performance for which Twitter was most important. It can also be seen that Face Book is again second (or tied for second) in importance with the exception of product/process intelligence, for which YouTube was second in importance. All SMPs were of third importance (or tied for third importance) at least once for cost performance.

Table 19. Summary Pairwise Assessment Matrix SMPs under Main Criteria

SMPs	Priority Score	Rank
LinkedIn	**0.322**	1
Facebook	**0.206**	2
Twitter	**0.176**	3
YouTube	**0.171**	4
Instagram	**0.153**	5

Table 20. Normalized Pairwise Comparison Matrix of the Main Criteria Level 3

Type of SCI	Weight	Rank
Logistics	**0.186**	1
Product/Process	**0.178**	2
SC Visibility	**0.172**	3
Demand	**0.171**	4
Supplier	**0.169**	5
Political/Economic	**0.119**	6

Table 21. Normalized Pairwise Comparison Matrix of the Main Criteria Level 2

Criteria→↓	Weight	Rank
Delivery	0.190	3
Quality	0.256	1
Assurance of Supply	0.230	2
Flexibility	0.171	4
Cost	0.125	5

Table 22. AHP Consistency Results

Criteria→↓	CR	Result
Delivery	0.013	< 0.10
Quality	0.005	< 0.10
Assurance of Supply	0.034	< 0.10
Flexibility	0.016	< 0.10
Cost	0.008	< 0.10

Accounting for the relationships shown in Tables 8-18, Tables 19-21 show the overall importance for each SMP, each type of SCI, and each supply chain performance measure. Table 22 confirms the overall consistency of responses across the participants for each supply chain performance measure. From Table 19 it can be seen that LinkedIn has higher importance compared to other SMPs. With respect to the overall priority scores, the three most important SMPs were found. LinkedIn (0.322) is the most preferred social media platform option, followed by Facebook (0.206), Twitter (0.176), YouTube (0.171), and Instagram (0.153), respectively. These results are depicted graphically in Figure 4. Figure 5 depicts the same results independently for each participant, showing that they are fairly consistent across participants.

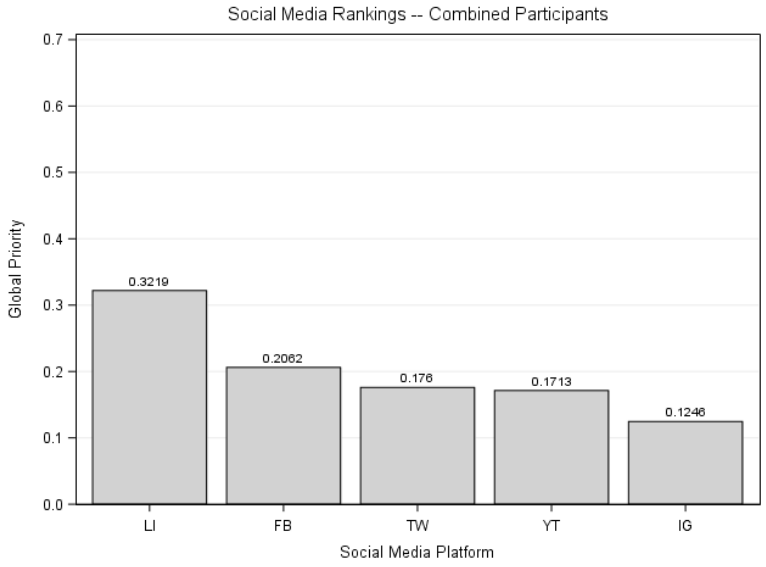

Figure 4. Over all Scores Chart

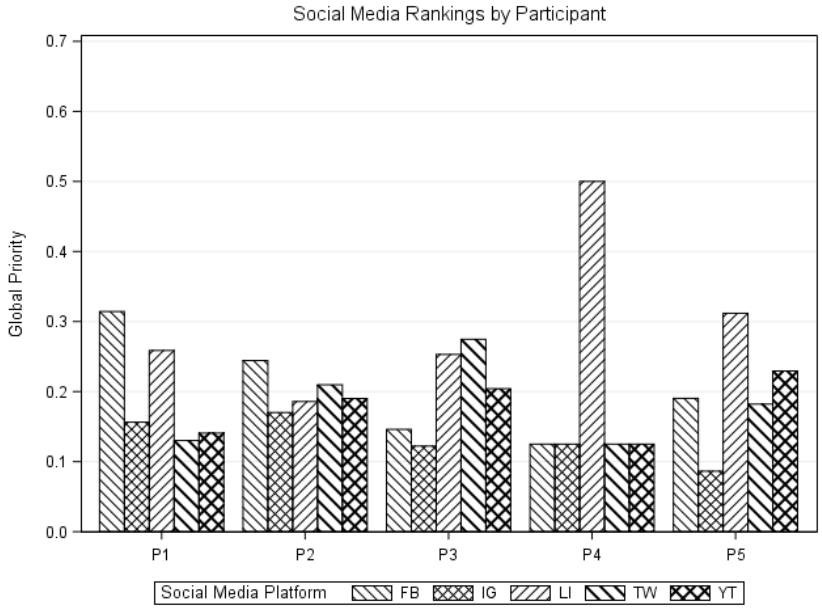

Figure 5. Over all Scores Chart

Multiple observations can made regarding the rankings of the various SMPs. First, it is interesting to observe that the top three SMPS are all text-based, while the bottom two are visual-based (e.g. video and image). This suggests that supply chain managers may be more dependent on text-based rather than visual-based SMS for SCI. Second, among the text-based SMPS LinkedIn has the highest ranking. The main reasons as to why LinkedIn was the most preferred

SMP alternative are as follows. As far as stories, events that are taking place from hour to hour, that are accepted in remaining current, LinkedIn appears to be distinct action of events /or venue, when comparing to Facebook or Twitter altogether (Chris Croll, 2013). LinkedIn is nothing but about work, most of the connections are occupied to worry about unduly unimportant matters/or updates.

Using LinkedIn to assist how to manage organizations, one needs to be mindful that there are dangers. Such as from not comprehending the "culture" and anticipation of the site's millions of users (Croll, 2013). Witzig et al. (2012) investigated how LinkedIn was found to be an effective SMP that served as a link between the Financial Planner's Association (FPA) and its potential customers. Witzig et al. (2012) also provides a review of previous studies that examine LinkedIn in several dissimilar situations. These studies range from investigating the tone of interpersonal communication (Zizi, 2009) to studying how LinkedIn has influenced human resources regarding employment and dismissal (Davison et al., 2011). LinkedIn can also provide an opportunity for communicating with part of an organization's audience, particularly, those who prefer to take part in an organization's online network pursuits. This is of particular importance for new, charitable, and nonprofit organizations (Daniasa et al., 2010).

Third, we see that Facebook is ranked higher than Twitter. A clear advantage of Facebook over Twitter is that the information once posted is available for a significant amount of time. In contrast, Twitter feeds are constantly updating. Hence, it seems that the more stable and detailed data on Facebook is valued more highly for SCI. Fourth, when considering the ranking of the visual-based SMPs a similarly comparison can be drawn. The more stable and detailed content available on YouTube is again valued more highly then given then the rapidly changing content of Instagram.

Summary

Chapter 4 discussed the findings of our study, presented the data, and provided analysis and interpretation of the data.

CHAPTER 5. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

This chapter provides a synopsis of the conclusions from the study and describes proposed future research. As a result of the emergence of SMPs, organizations are experiencing a shift in how supply chain members communicate information. This raises the challenge of how SCI can be extracted from SMPs to improve supply chain performance. It seems likely that SMPs should be able to assist organizations to better comprehend customers' needs, rivals' strategic moves and factors impacting supply chain members. Given the rapidly changing business environment with which organizations are now confronted, organizations who use SMPs effectively to acquire and leverage SCI should have a clear competitive advantage. Despite this, to our knowledge, there is no systematic way for decision makers to select which SMPs to use and in what way to use them in order to establish this competitive advantage. Our work takes a first step in demonstrating how the appropriate SMPs and their use can be identified for an organization through the use of AHP.

Our study used AHP to collect and analyze data on the relative importance of five supply chain performance measures, six types of SCI, and five SMPs. Based on AHP with five participants identified the most important SMP as LinkedIn, followed by Facebook and Twitter. Our study has established that AHP can be applied in the context of supply chain performance to help select SMPs and the types of SCI for which each can be used.

Limitations

The primary limitation of our study was the low response rate with only five participants' data being used for the analysis. Though five is a commonly accepted number of participants for AHP, due to the small number of participants, the results have limited generalizability. However, the methodology developed has been used successful and can be applied at additional

organizations to assist in developing strategies for using SMPs to acquire SCI to improve supply chain performance.

Summary and Future Research

This study investigated the impact of SMPs on supply chain performance in an organization to select the SMPs policy options. Achieving this primary governing goal necessitated using an MADM, specifically AHP. This model involved modeling supply chain performance and linking it to SMPs through various types of SCI by using AHP. AHP was chosen as it permits decision makers to model a complex problem in a hierarchical structure describing the connections of the primary goal (supply chain performance), decision criteria (supply chain performance measures), sub-criteria (types of SCI), and policy alternatives (SMPs). The particular objectives were to identify the most important SMPs (Facebook, Twitter, YouTube, LinkedIn and Instagram) and how they contribute to SCI which itself contributes to supply chain performance.

Results of the pairwise comparisons of the major decision criteria indicate that quality is the most important supply chain performance measure with a weight of 0.256 (26%). This finding suggests that quality is perceived as one of the most favorable factors serving to select the best SMPs for an organization. Assurance of supply and delivery are also major contributing factors for selection of SMPs with weights of 0.230 (23%) and 0.190 (19%), respectively. With respect to the major decision objectives, on the other hand, results of the priorities indicate that LinkedIn (0.322) is the most preferable SMP, followed by Facebook (0.206) and then Twitter (0.176).

The contribution of this study to the literature has been to apply AHP to modeling supply chain performance in an organization and how SMPs contribute to supply chain performance through SCI. Above all, the survey results show a high level of recognition of the importance that SMPs plays in acquiring SCI for supply chain improvement. The AHP approach established the

pertinence of SMPs innate importance to supply chain performance. As a result, organizations may consider using AHP to assess the specific impact of SMPs on their supply chain performance through SCI and thus prioritize their use of SMPs. Also, based on our results there appears to be a preference for those SMPs which are professional, text-based, and stable in their content. This observation could be the foundation of a theory for describing how SMPs are used to gather intelligence. That theory could then be tested through an empirical study.

REFERENCES

1. Ang, L. (2011). Is SCRM really a good social media strategy. *Journal of database Marketing & Customer Strategy Management*, *18*(3), 149-153.
2. Anica I. P. and Cucui G. (2009), A Framework for Enhancing Competitive Intelligence Capabilities using Decision Support System based on Web Mining Techniques, *Int. J. of Computers, Communications & Control,* ISSN 1841-9836, E-ISSN 1841-9844, Vol. IV (2009), No. 4, pp. 326- 334.
3. Bentes, A. V., Carneiro, J., da Silva, J. F., & Kimura, H. (2012). Multidimensional assessment of organizational performance: Integrating BSC and AHP. *Journal of business research*, *65*(12), 1790-1799.
4. Berthon, P., Pitt, L., McCarthy, I., & Kates, S. (2007). When customers get clever: Managerial approaches to dealing with creative consumers. *Business Horizons*, *50*(1), 39-47.
5. Bughin, J., and Chui, M. (2010). The Rise of the Networked Enterprise: Web 2.0 Finds its Payday. *McKinsley Quarterly*, 1-9.
6. Calof, J. and Skinner, B. (1999). Government's role in competitive intelligence: what's happening in Canada. *Competitive Intelligence Magazine*, *2*(2), 20-23.
7. Chaffey D., Chadwick F. E., Mayer R., (2009). Internet Marketing - Strategy, Implementation and Practice, fourth ed. *Prentice Hall/Financial Times*, Harlow, UK.
8. Chikandiwa, S. T. Contogiannis, E. and Jembere, E. (2013). The adoption of social media marketing in South African banks. *European business review*, Volume 25, 4, pp. 365–381.
9. Choi, T. M. (2016). Incorporating social media observations and bounded rationality into fashion quick response supply chains in the big data era. *Transportation Research Part E: Logistics and Transportation Review*.
10. Chopra, S., & Meindl, P. (2007). Supply chain management. *Strategy, planning & operation. In Das summa summarum des management* (pp. 265-275). Gabler.
11. Cogburn, D. L. and Espinoza-Vasquez, F. K. (2011). From networked nominee to networked nation: examining the impact of web 2.0 and social media on political participation and civic engagement in the 2008 Obama campaign. *Journal of political marketing*. Volume 10, pp. 189–213.
12. Cox, A. (1999). Power, value and supply chain management. *Supply chain management: An international journal*, 4(4), 167-175.
13. Croll, C. (2013). Benefits & Risks for Nonprofit Leaders Using Linkedin. *Nonprofitworld.org*.
14. Culnan, M., P. McHugh, and J. Zubillaga. 2010. "How large U.S. companies can use twitter and other social media to gain business value." MIS Quarterly Executive 9(4): 243–259. *CustomerStrategyManagement*,18(3),149- 153. doi:l0.1057/dbm.2011.22.

15. Daniasa, C, Tomita, V., Stupam, D and, Stanciu, M. (2010), The Mechanisms of the Influence of Viral Marketing in Social Media, *Economics, Management, and Financial Markets*, 5(3), 278-282.

16. Davison, H., Maraist, C. and Bing, M. (2011), Friend or Foe? The Promise and Pitfalls of Using Social Networking Sites for HR Decisions, *Journal of Business and Psychology*, 28 (2) 153-159.

17. Dey, L., Haqne, S. M., Khurdiya, A., Shroff, G. (2011). AcquiPIIg competitive intelligence from social media. *Proceedings of the 2011 Joint Workshop on Multilingual OCR and Analytics fur Noisy Unstructured Text Data*, Bejing, China.ACM.Retrieved from http://dLacm.org/citadon.ofm?id=203462 doi:l0.114512034617.2034621.

18. Dixon, B. (2012). Social media for school leaders: A comprehensive guide to getting the most out of Facebook, Twitter, and other essential web tools. *John Wiley & Sons*.

19. Fisher, R., McPhail, R., You, E. and Ash, M. (2014). Using Social Media to Recruit Global Supply Chain Managers. *International Journal of Physical Distribution and Logistics Management,* 4(1), 26-37.

20. Gavade, R. K. (2014). Multi-Criteria Decision Making: An overview of different selection problems and methods. *International Journal of Computer Science and Information Technologies, 5*(4), 5643-5646.

21. Griffiths, P., Wall, A. (2011). Social media use by enrollment management. In Higher Education Administration with Social Media (pp. 49-67). *Emerald Group Publishing Limited.*

22. Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics*, 87(3), 333-347.

23. Gundecha, P., Liu, H. (2012). Mining social media: a brief introduction. *Tutorials in Operations Research,* 1(4).

24. Gupta, A. K., Tesluk, P. E., & Taylor, M. S. (2007). Innovation at and across multiple levels of analysis. *Organization science*, 18(6), 885-897.

25. Haji M. N., Sims J., Featherman, M., Love, P. E. D. (2015). Credibility of information in online communities. *Journal of Strategic Marketing, 23* (3), 238--253. doi 10.108010965254X.2014.920904.

26. Haydock, M. P. (2003). Supply Chain Intelligence | SAS. SAS Institute, 15–21. *Retrieved from http://www.sas.com/en_us/software/supply-chain.html.*

27. He, W;, Zha, S., & U,L.(2013). Social media competitive analysis and text mining: A case study in the pizza industry. *International Journal of Information Management*, 33(3),464-472. doi:10.1016/j.ijinfomgt.2013.01.001.

28. Jaharuddin, N. S., Mohamad, Z. A. and Sambasivan, M. (2014). Supply Chain Intelligence and Its Impact on Business Performance, *International Journal of Economics and Management,* 8(S) 177-203.

29. Kaplan, A. M., Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons, 53*(1), 59-68.

30. Kietzmann J., Hermkens K., McCarthy I., Silvestre, B. (2011). Social media? Get serious! Understanding the functional building blocks of social media. *Business Horizons* (54), 241-251.

31. Klaus, P. (2011). The assessment of competitive intensity in logistics markets. *Logistics Research, 3*(1), 49–65. https://doi.org/10.1007/s12159-011-0050-0

32. Levy, S. E., Duan, W., & Boo, S. (2013). An analysis of one-star online reviews and responses in the Washington, DC, Lodging Market. *Cornell Hospitality Quarterly*, 54(1), 49–63. doi:10.1177/1938965512464513.

33. Lieb, R. (2009). The truth about search engine optimization. *Pearson Publishing's Financial Times*, USA. Retrieved from http://www.rebeccalieb.com.

34. Lin, K. P., Hung, K. C., Lin, Y. T., & Hsieh, Y. H. (2017). Green Suppliers Performance Evaluation in Belt and Road Using Fuzzy Weighted Average with Social Media Information. *Sustainability*, *10*(1), 5.

35. Luthra, S., Mangla, S. K., Xu, L., & Diabat, A. (2016). Using AHP to evaluate barriers in adopting sustainable consumption and production initiatives in a supply chain. *International Journal of Production Economics*, 181, 342–349. https://doi.org/10.1016/j.ijpe.2016.04.001

36. Macafee, T., and De Simone, J. J. (2012). Killing the bill online? Pathways to young people's protest engagement via social media. *Cyberpsychology, Behavior, and Social Networking*, 15(11), 579-584.

37. Makrez, H. M. (2011). Am I invited? Social media and alumni relations. In *Higher Education Administration with Social Media* (pp. 229-248). Emerald Group Publishing Limited.

38. Mangold, W. G. and Faulds, D. J. (2009). Social Media: The New Hybrid Element of the Promotion Mix. *Business Horizons* 52: 357-365.

39. Meixner, O., Haas, R., Moosbrugger, H. and Magdits, P. (2013). Interaction with customers: The Application of Social Media within the Austrian Supply Chain for Food and Beverages. *Int. J. Food System Dynamics*, 4(1), 26-37.

40. Moe, W. W., Schweidel, D. A. (2014). Social media intelligence. Cambridge University Press.doi: l0.1017/ CB09781139381338. Operation, Upper Saddle River, NJ: Prentice-Hall.

41. O'leary, D. E. (2011). The use of social media in the supply chain: Survey and extensions. *Intelligent Systems in Accounting, Finance and Management*, 18(2-3), 121-144.

42. Rappaport, S.D. (2011). Listen first! Turning social media conversations into business advantage. Hoboken, NJ., United States: John Wiley & Sons.

43. Saaty T. L. (1980). The Analytic Hierarchy Process. Planning, Priority Setting, *Resource Allocation*. New York: McGraw-Hill.

44. Sarode, A. D., Sunnapwar, V. K., & Khodke, P. M. (2008). A Literature Review for Identification of Performance Measures for Establishing a Framework for Performance Measurement in Supply Chains. *International Journal of Applied Management and Technology*, 6(3).

45. Singh, A., Shukla, N., & Mishra, N. (2017). Social media data analytics to improve supply chain management in food industries. *Transportation Research Part E: Logistics and Transportation Review*.

46. Stefanovic, N and Stefanovic, D. (2009), "Supply chain business intelligence: technologies, issues and trends", In Artificial intelligence, Max Bramer (Ed.), *Lecture Notes In Computer Science* (5640, pp.217-245), Springer-Verlag, Berlin: Heidelberg.

47. Subramani, M. (2004), "How do suppliers benefit from information technology use in supply chain relationships?", *MIS Quarterly, Vol. 28* No. 1, pp. 45-73.

48. Tej Adidam, P., Banerjee, M., & Shukla, P. (2012). Competitive intelligence and firm's performance in emerging markets: an exploratory study in India. *Journal of Business & Industrial Marketing, 27*(3), 242-254.

49. Vuori V., Väisänen J. (2009). The use of social media in gathering and sharing competitive intelligence. *In 9th International Conference on Electronic Business*.

50. Vuori, V. (2011). Social media changing the competitive intelligence process: elicitation of employees' competitive knowledge. *Tampereen teknillinen yliopisto. Julkaisu-Tampere University of Technology. Publication; 1001*.

51. Webb, L. M., Wilson, M. L., Hodges, M., Smith, P. A., & Zakeri, M. (2012). Facebook: How college students work it. *Social media: Usage and impact*, 3-22.

52. Wheeler, A. (2013). Designing brand identity: An essential guide for the whole branding team. Hoboken, NJ: *John Wiley & Sons*.

53. Wilkins L. Richard. (2007). "Competitive Intelligence: The New Supply Chain Edge." *Supply Chain Management Review* http://www.scmr.com/index.asp?layout=articlePrint&articleID=CA6406211&article_prefi.

54. Williams, B. D., Roh, J., Tokar, T., & Swink, M. (2013). Leveraging supply chain visibility for responsiveness: The moderating role of internal integration. *Journal of Operations Management*, *31*(7–8), 543–554. https://doi.org/10.1016/j.jom.2013.09.003.

55. Witzig, L., Spencer, J., & Galvin, M. A. R. I. N. (2012). Organizations' use of LinkedIn: An analysis of nonprofits, large corporations and small businesses. *Marketing Management Journal*, *22*(1), 113-121.

56. Zeng, D., Chen, H., Lusch, R., & Ll, S. H. (2010). Social media analytics and intelligence. *IEEE Intelligent Systems*, *25*(6), 13-16. doi:IO. ll09/MIS.2010.151.

57. Zizi, P. (2009), The Virtual Geographies of Social Networks: A Comparative Analysis of Facebook, Linkedin and ASmallWorld, *New Media Society*, 11(10), 199-222.

APPENDIX A. ORGANIZATION STUDY QUESTIONNAIRE

Sample survey instructions:

Please select the number that best represents the relative importance of the two criteria for supply chain performance.

Instruction: If you select "4" on the "Delivery" side in the following question, that means "Delivery" is 4 times as important as "Quality."

1	Delivery	9	8	7	6	5	(4)	3	2	1	2	3	4	5	6	7	8	9	Quality

If you select the number "1" in the following question, that means "Delivery" is as important as "Quality"

2	Delivery	9	8	7	6	5	4	3	2	(1)	2	3	4	5	6	7	8	9	Quality

If you select "7" on the "Quality" side in the following question that means "Quality" is 7 times as important as "Delivery."

3	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	(7)	8	9	Quality

Question 1. Please select the number that indicates the relative importance of the two criteria with respect to supply chain performance.

1	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Quality
2	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Assurance of supply
3	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Flexibility
4	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost
5	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Assurance of supply
6	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Flexibility
7	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost
8	Assurance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Flexibility
9	Assurance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost
1	Flexibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost

Question 2. Please select the number that indicates the relative importance of the forms of intelligence to Delivery with respect to improving supply chain performance.

1	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Demand Intelligence
2	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Process Intelligence
3	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier Intelligence
4	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Logistics Intelligence
5	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Political & Economic Intelligence
6	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply Chain Visibility Intelligence

Question 3. Please select the number that indicates the relative importance of the forms of intelligence and Quality with respect to improving supply chain performance.

1	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Demand Intelligence
2	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Process Intelligence
3	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier Intelligence
4	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Logistics Intelligence
5	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Political & Economic Intelligence
6	Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply Chain Visibility Intelligence

Question 4. Please select the number that indicates the relative importance of the forms of intelligence and Assurance of Supply with respect to improving supply chain performance.

1	AS	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Demand Intelligence
2	AS	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Process Intelligence
3	AS	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier Intelligence
4	AS	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Logistics Intelligence
5	AS	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Political & Economic Intelligence
6	AS	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply Chain Visibility Intelligence

Question 5. Please select the number that indicates the relative importance of the forms of intelligence and Flexibility with respect to improving supply chain performance.

1	Flexibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Demand intelligence
2	Flexibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Process intelligence
3	Flexibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier intelligence
4	Flexibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Logistics intelligence
5	Flexibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Political & Economic Intelligence
6	Flexibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply Chain Visibility Intelligence

Question 6. Please select the number that indicates the relative importance of the forms of intelligence and Cost with respect to improving supply chain performance.

1	Cost	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Demand intelligence
2	Cost	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Process intelligence
3	Cost	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier intelligence
4	Cost	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Logistics intelligence
5	Cost	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Political & Economic Intelligence
6	Cost	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply Chain Visibility Intelligence

Relating Social Media Platforms to Intelligence

Question 7. Please select the number that indicates the relative importance of the two social media platforms with respect to Demand Intelligence.

1	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	YouTube
2	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
3	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
4	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
5	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
6	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
7	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
8	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
9	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
10	LinkedIn	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram

Question 8. Please select the number that indicates the relative importance of the two social media platforms with respect to Product & Process Intelligence.

1	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	YouTube
2	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
3	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
4	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
5	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
6	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Linked in
7	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
8	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
9	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
10	LinkedIn	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram

Question 9. Please select the number that indicates the relative importance of the two social media platforms with respect to Supplier Intelligence.

1	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	YouTube
2	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
3	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
4	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
5	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
6	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Linked in
7	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
8	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
9	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
10	LinkedIn	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram

Question 10. Please select the number that indicates the relative importance of the two social media platforms with respect to Logistics Intelligence.

1	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	YouTube
2	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
3	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
4	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
5	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
6	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Linked in
7	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
8	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
9	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
10	LinkedIn	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram

Question 11. Please select the number that indicates the relative importance of the two social media platforms with respect to Political & Economic Intelligence.

1	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	YouTube
2	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
3	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
4	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
5	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
6	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Linked in
7	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
8	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
9	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
10	LinkedIn	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram

Question 12. Please select the number that indicates the relative importance of the two social media platforms with respect to Supply Chain Visibility Intelligence.

1	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	YouTube
2	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
3	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
4	Facebook	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
5	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Twitter
6	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Linked in
7	YouTube	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
8	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LinkedIn
9	Twitter	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram
10	LinkedIn	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Instagram

Question 13. Indicate how familiar you are with each of the supply chain performance criteria where 1 indicates not familiar and 5 indicates very familiar?

	Criteria	1	2	3	4	5
1	Delivery					
2	Quality					
3	Assurance of Supply					
4	Flexibility					
5	Cost					

Question 14. Indicate how familiar you are with the forms of intelligence within your organization where 1 indicates not familiar and 5 indicates very familiar?

	Sub-criteria	1	2	3	4	5
1	Demand Intelligence					
2	Process Intelligence					
3	Suppliers Intelligence					
4	Logistics Intelligence					
5	Political/Economic					
6	Supply Chain Visibility					

Question 15. Indicate how familiar you are with each of the following SMPs in your organization where 1 indicates not familiar and 5 indicates very familiar?

	Decision Alternatives	1	2	3	4	5
1	Facebook					
2	YouTube					
3	Twitter					
4	LinkedIn					
5	Instagram					

Question 16. In what industry is your current position?

Question 17. What is the title of your current position?

Question 18. How many years of managerial work experience have you had?

Question 19. What is your gender?

Male	Female	Preferred not to answer

APPENDIX B. LETTER TO PARTICIPANTS

SURVEY INVITATION LETTER

Re: The Impact of Social Media on Supply Chain Performance through Competitive Intelligence.

Introduction

Dear. Supply Chain Management Professional,
This letter pertains to graduate study research being conducted by Fesseha Gebremikael at North Dakota State University. The research study focuses on the impact of social media on supply chain performance through competitive intelligence. The objective of the study is to build a framework that provides a systematic approach to the use of social media platforms to improve supply chain performance.

The research requires the input of supply chain management professionals. As such a professional, your input will be collected through the attached survey. All aspects of your input to the research are confidential and all responses will be observed solely by the researcher and no other individual or party. It would be greatly appreciated if you respond to the following questions by ___ 2017. It should take approximately 15 minutes to complete the questions. Please click on the survey link below to participate in the study:
<Survey Link>

Your participation in this study is voluntary. You reserve the exclusive right to choose to respond to the questions or not, and to discontinue your participation at any time without any penalty or loss of benefits to which you are otherwise entitled. Your decision to participate or not to participate in no way, in the present or the future, affects your relations with NDSU.

If you have any questions regarding your rights as a research subject, or if you have any concerns or complaints about the research, you may contact the NDSU Institutional Review Board (IRB) Office at (701) 231-8995. If you have questions specific to this research project, please contact Fesseha Gebremikael at (701) 200-0073 or my major advisor, Dr. Joseph Szmerekovsky, at (701) 231-8128 or joseph.szmerekovsky@ndsu.edu.
Thank you in advance for your valuable contribution to this research project.

Yours Sincerely,
Fesseha Gebremikael

APPENDIX C. EXCEL CALCULATIONS

Social Media	DL					
	DI	PPI	SI	LI	PEI	SCVI
FB	0.006	0.005	0.006	0.009	0.006	0.007
IG	0.004	0.004	0.003	0.004	0.003	0.006
LI	0.008	0.011	0.011	0.012	0.005	0.013
TW	0.005	0.005	0.004	0.007	0.007	0.006
YT	0.004	0.007	0.005	0.008	0.003	0.005
Totals	*0.028*	*0.033*	*0.028*	*0.040*	*0.023*	*0.037*
	0.190					

Social Media	QL					
	DI	PPI	SI	LI	PEI	SCVI
FB	0.011	0.008	0.010	0.010	0.007	0.007
IG	0.007	0.006	0.005	0.005	0.003	0.006
LI	0.015	0.017	0.019	0.013	0.006	0.013
TW	0.009	0.007	0.008	0.007	0.008	0.006
YT	0.008	0.010	0.008	0.008	0.004	0.005
Totals	*0.050*	*0.048*	*0.050*	*0.042*	*0.028*	*0.037*
	0.256					

Social Media	AS					
	DI	PPI	SI	LI	PEI	SCVI
FB	0.008	0.006	0.010	0.009	0.006	0.008
IG	0.006	0.005	0.005	0.004	0.003	0.007
LI	0.012	0.013	0.018	0.012	0.006	0.014
TW	0.007	0.006	0.007	0.006	0.007	0.006
YT	0.006	0.008	0.008	0.007	0.004	0.006
Totals	*0.039*	*0.037*	*0.047*	*0.038*	*0.026*	*0.041*
	0.230					

Social Media	FL					
	DI	PPI	SI	LI	PEI	SCVI
FB	0.006	0.005	0.004	0.008	0.005	0.006
IG	0.004	0.004	0.002	0.004	0.002	0.005
LI	0.009	0.011	0.008	0.010	0.005	0.011
TW	0.005	0.005	0.003	0.006	0.006	0.005
YT	0.005	0.007	0.004	0.007	0.003	0.005
Totals	*0.029*	*0.031*	*0.021*	*0.035*	*0.022*	*0.033*
	0.171					

Social Media	CT					
	DI	PPI	SI	LI	PEI	SCVI
FB	0.005	0.005	0.005	0.007	0.005	0.005
IG	0.004	0.004	0.002	0.003	0.002	0.004
LI	0.007	0.010	0.009	0.009	0.005	0.008
TW	0.005	0.004	0.004	0.005	0.006	0.004
YT	0.004	0.006	0.004	0.006	0.003	0.004
Totals	*0.025*	*0.029*	*0.025*	*0.031*	*0.020*	*0.024*
	0.153					

Total	Rank
0.206	2
0.125	5
0.322	1
0.176	3
0.171	4
1.000	

APPENDIX D. SAS PROGRAM CODE

```
options date ls=100 ps=65 formchar="|----|+|---+=|-/\<>*" ;

ods graphics / noborder;

libname sas 'S:\VPIT\Stats_Consulting\Kristen\Fesseha Gebremikael';

title 'Fesseha Gebremikael -- AHP';
title2 'Data Import';

proc format;
 value gender          1='Male'
                       2='Female'
                       3='Prefer not to answer';

 value ethn            1='Caucasian'
                       2='Non-Caucasian'
                       3='Prefer not to answer';

 value p 6='Combined';

 run;


data survey;
 infile 'all respondents_new.csv' dsd dlm=',' firstobs=3 missover;
 input (JF1 - JF9) ($)  JF10 - JF47  Q1_1 - Q1_10  Q2_1 - Q2_15  Q3_1 - Q3_15
            Q4_1 - Q4_15  Q5_1 - Q5_15  Q6_1 - Q6_15  Q7_1 - Q7_10  Q8_1 - Q8_10
            Q9_1 - Q9_10  Q10_1 - Q10_10  Q11_1 - Q11_10  Q12_1 - Q12_10
            Q13_1 - Q13_5  Q14_1 - Q14_6  Q15_1 - Q15_5  Q16 :$31.  Q17 :$15.
            Q18  Q19  Q20  JF48 - JF50;
 Participant=_n_;
 label Q13_1='Familiarity with Supply Chain Performance Criteria -- Delivery'
            Q13_2='Familiarity with Supply Chain Performance Criteria -- Quality'
            Q13_3='Familiarity with Supply Chain Performance Criteria -- Assurance'
            Q13_4='Familiarity with Supply Chain Performance Criteria -- Flexibility'
            Q13_5='Familiarity with Supply Chain Performance Criteria -- Cost'
            Q14_1='Familiarity with Intelligence Form -- Demand'
            Q14_2='Familiarity with Intelligence Form -- Process'
            Q14_3='Familiarity with Intelligence Form -- Suppliers'
            Q14_4='Familiarity with Intelligence Form -- Logistics'
            Q14_5='Familiarity with Intelligence Form -- Political/Economic'
            Q14_6='Familiarity with Intelligence Form -- Supply Chain Visibility'
            Q15_1='Familiarity with Social Media Platforms -- Facebook'
            Q15_2='Familiarity with Social Media Platforms -- YouTube'
            Q15_3='Familiarity with Social Media Platforms -- Twitter'
            Q15_4='Familiarity with Social Media Platforms -- LinkedIn'
            Q15_5='Familiarity with Social Media Platforms -- Instagram'
            Q19='What is your gender?'
            Q20='What is your ethnicity?';
 drop JF1 - JF47 jf48 - jf50;
 run;


data survey2;
  set survey;
  array new{145} TQ1_1 - TQ1_10          TQ2_1 - TQ2_15      TQ3_1 - TQ3_15       TQ4_1 - TQ4_15
                                         TQ5_1 - TQ5_15      TQ6_1 - TQ6_15  TQ7_1 - TQ7_10  TQ8_1 - TQ8_10
                                         TQ9_1 - TQ9_10      TQ10_1 - TQ10_10    TQ11_1 - TQ11_10    TQ12_1 - TQ12_10;
  array inv{145} invQ1_1 - invQ1_10      invQ2_1 - invQ2_15  invQ3_1 - invQ3_15  invQ4_1 - invQ4_15
                                         invQ5_1 - invQ5_15  invQ6_1 - invQ6_15  invQ7_1 - invQ7_10  invQ8_1 - invQ8_10
                                         invQ9_1 - invQ9_10  invQ10_1 - invQ10_10          invQ11_1 - invQ11_10          invQ12_1
- invQ12_10;
  array old{145} Q1_1 - Q1_10    Q2_1 - Q2_15        Q3_1 - Q3_15        Q4_1 - Q4_15
                                         Q5_1 - Q5_15        Q6_1 - Q6_15  Q7_1 - Q7_10  Q8_1 - Q8_10
```

```
                                        Q9_1 - Q9_10        Q10_1 - Q10_10      Q11_1 - Q11_10      Q12_1 - Q12_10;

 do i=1 to 145;
   if old{i} <= 9 then new{i}=10-old{i};
              else if old{i} > 9 then new{i}= 1/(abs(8-old{i}));
              else new{i}=.;

    inv{i} = 1/new{i};
 end;
 diag=1;
 drop i;
 run;

*ods rtf file='Verify Original Data.rtf';

proc print data=survey;
 title2 'Verify Original Data';
 run;

*ods rtf close;

*ods rtf file='Verify Re-formatted Data.rtf';

proc print data=survey2;
 var TQ1_1 - TQ1_10 TQ2_1 - TQ2_15      TQ3_1 - TQ3_15      TQ4_1 - TQ4_15
              TQ5_1 - TQ5_15      TQ6_1 - TQ6_15  TQ7_1 - TQ7_10  TQ8_1 - TQ8_10
              TQ9_1 - TQ9_10      TQ10_1 - TQ10_10    TQ11_1 - TQ11_10    TQ12_1 - TQ12_10
              Q13_1 - Q13_5  Q14_1 - Q14_6  Q15_1 - Q15_5  Q16   Q17
              Q18  Q19  Q20 ;
 title2 'Verify Re-formatted Data';
 run;

*ods rtf close;
/*
data sas.survey;
 set survey2;
 run;


*/

*ods rtf file='Combined Participant Summaries -- Updated 11-15-17.rtf';

proc freq data=survey;
 table  Q13_1 - Q13_5
                        Q14_1 - Q14_6
                        Q15_1 - Q15_5
                        Q19  Q20;
 format q19 gender. q20 ethn.;
 run;

*ods rtf close;


****** Combined data using averages *******;


proc means data=survey mean noprint;
* where participant ne 2;
 var  Q1_1 - Q1_10     Q2_1 - Q2_15          Q3_1 - Q3_15          Q4_1 - Q4_15
                                             Q5_1 - Q5_15          Q6_1 - Q6_15  Q7_1 - Q7_10  Q8_1 - Q8_10
                                             Q9_1 - Q9_10          Q10_1 - Q10_10      Q11_1 - Q11_10      Q12_1 - Q12_10;
 output out=combined(drop=_type_ _freq_)  mean= / ;
 run;

data combined2;
  set combined;
  array new{145} TQ1_1 - TQ1_10          TQ2_1 - TQ2_15      TQ3_1 - TQ3_15      TQ4_1 - TQ4_15
                                         TQ5_1 - TQ5_15      TQ6_1 - TQ6_15  TQ7_1 - TQ7_10  TQ8_1 - TQ8_10
                                         TQ9_1 - TQ9_10      TQ10_1 - TQ10_10    TQ11_1 - TQ11_10    TQ12_1 - TQ12_10;
```

```
 array inv{145} invQ1_1 - invQ1_10        invQ2_1 - invQ2_15  invQ3_1 - invQ3_15  invQ4_1 - invQ4_15
                                          invQ5_1 - invQ5_15  invQ6_1 - invQ6_15  invQ7_1 - invQ7_10  invQ8_1 - invQ8_10
                                          invQ9_1 - invQ9_10  invQ10_1 - invQ10_10          invQ11_1 - invQ11_10          invQ12_1
- invQ12_10;
 array old{145} Q1_1 - Q1_10   Q2_1 - Q2_15          Q3_1 - Q3_15          Q4_1 - Q4_15
                                          Q5_1 - Q5_15          Q6_1 - Q6_15  Q7_1 - Q7_10  Q8_1 - Q8_10
                                          Q9_1 - Q9_10          Q10_1 - Q10_10       Q11_1 - Q11_10       Q12_1 - Q12_10;

 do i=1 to 145;
  if old{i} <= 9 then new{i}=10-old{i};
            else if old{i} > 9 then new{i}= 1/(abs(8-old{i}));
            else new{i}=.;

  inv{i} = 1/new{i};
 end;
 diag=1;
 Participant=6;
 drop i;
 format participant p.;
 run;


proc print data=combined2;
 var TQ1_1 - TQ1_10 TQ2_1 - TQ2_15       TQ3_1 - TQ3_15       TQ4_1 - TQ4_15
            TQ5_1 - TQ5_15      TQ6_1 - TQ6_15  TQ7_1 - TQ7_10  TQ8_1 - TQ8_10
            TQ9_1 - TQ9_10      TQ10_1 - TQ10_10    TQ11_1 - TQ11_10    TQ12_1 - TQ12_10 Participant;
 title2 'Verify Re-formatted Data';
 run;
```

APPENDIX E. NDSU IRB APPROVAL LETTER

NDSU NORTH DAKOTA STATE UNIVERSITY

May 9, 2017

Dr. Joseph Szmerekovsky
Management & Marketing

Re: IRB Determination of Exempt Human Subjects Research:
Protocol #BA17249, "The Impact of Social Media on Supply Chain Performance Through Competitive Intelligence"

Co-investigator(s) and research team: Fesseha Gebremikael, Laura Trude
Certification Date: 5/9/2017 Expiration Date: 5/8/2020
Study site(s): online
Sponsor: n/a

The above referenced human subjects research project has been certified as exempt (category #2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects). This determination is based on the protocol submission (received 5/8/2017).

Please also note the following:
• If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
• The study must be conducted as described in the approved protocol. Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
• Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
• Report any significant new findings that may affect the risks and benefits to the participants and the IRB.

Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.
Sincerely,

Kristy Shirley
Digitally signed by Kristy Shirley
DN: cn=Kristy Shirley, o=NDSU, ou=Institutional Review Board, email=kristy.shirley@ndsu.edu, c=US
Date: 2017.05.09 10:38:58 -05'00'

Kristy Shirley, CIP, Research Compliance Administrator

For more information regarding IRB Office submissions and guidelines, please consult http://www.ndsu.edu/research/integrity_compliance/irb/. This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

INSTITUTIONAL REVIEW BOARD
NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | 701.231.8995 | Fax 701.231.8098 | ndsu.edu/irb

Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102